A STUDY OF PROBLEMS OF SCIENCE EDUCATION AND ATTITUDE OF STUDENTS TOWARDS SCIENCE IN HIGH SCHOOLS OF EAST KHASI HILLS DISTRICT, MEGHALAYA

Thesis Submitted for the Degree of

DOCTOR OF PHILOSOPHY IN EDUCATION

RANI. S. D.

To

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To

DEPARTMENT OF EDUCATION
SCHOOL OF HUMANITIES AND EDUCATION
NORTH-EASTERN HILL UNIVERSITY
SHILLONG, MEGHALAYA - 793022

JUNE 1996

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पूर्वोत्तर पर्वतीय विश्वविद्यालय
पू॰ प॰ गिरि॰ परिसर, शिलांग - 793022 (मेघालय)
North-Eastern Hill University
NEHU Campus, Shillong - 793022 (Meghalaya)

Phone :
Grams : NEHU

Dr. M.A. Sudhir
Professor and Head
Department of Education

Certificate

Certified that the thesis, **A Study of Problems of Science Education and Attitude of Students Towards Science in High Schools of East Khasi Hills District, Meghalaya,** submitted for the degree of Doctor of Philosophy in Education of North-Eastern Hill University, is the result of bonafide research carried out by Miss. Rani, S.D. under my supervision and guidance. This thesis or any part of thereto has not been submitted for any degree in this or any other University.

Shillong
June 19, 1996

19.6.96
(M. A. Sudhir)

DECLARATION

I do hereby declare that the thesis **A Study of Problems of Science Education and Attitude of Students Towards Science in High Schools of East Khasi Hills District, Meghalaya,** or any part thereto has not been submitted for any degree in the North-Eastern Hill University or any other University.

Rani. S.D

Place : NEHU, Shillong
Date : 19 May, 1996

Rani, S.D.
Research Scholar
Deptt. of Education
North-Eastern Hill University

ACKNOWLEDGEMENT

The investigator is extremely grateful to Dr. M.A. Sudhir, Head, Department of Education, North-Eastern Hill University under whose incessant and inspiring guidance this study was conducted. His assistance, patience and encouragement enabled the investigator to conduct this work systematically.

The investigator gratefully acknowledged her profound gratitude to Dr. Mathew George, former Reader, Department of Education, who rendered valuable help for the successful completion of this study.

For the help and suggestions, grateful acknowledgement is made to all members of the teaching faculty in the Department of Education.

Sincere thanks are extended to the headmasters, headmistresses, science teachers and students for their valuable co-operation during the data collection.

The investigator is thankful to the librarians of the Department of Education for their help.

The investigator is greatly indebted to Dr. N.P. Goel, Department of Geography, NEHU, Shillong for data processing on Computer and Mrs. Goel for typing out this manuscript within a short period of time.

The Investigator owe sincere and lively thanks to her parents for their thoughtfulness and encouragement during the period of work.

Finally, the investigator wishes to place on record her indebtedness to her friends and colleagues who have contributed directly or indirectly to make this study a success.

Rani. S.D

Rani, S.D.

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CHAPTER I

INTRODUCTION

INTRODUCTION

1.1 Introductory Statement

Science exists as a major institutional complex in modern societies, and its cultural and economic significance is now universally recognized (Barnes, 1972). Science being a vital factor in the development of human civilization, in an age of space technology it has permeated through all aspects of human life and has become everyman's every day concern. Perhaps no other branch of human thought could exert such a powerful influence on man's social, moral, economic and cultural life as science has.

Science from its inception had a revolutionary role, it has broken through stagnant societies and given them new horizons and brought them face to face with newer and refined understanding. It remains both exciting and revolutionary. Science is a method of solving problems, an intellectual tool, and a means for exploring the unknown. Historically speaking science is the oldest of all disciplines but it is only in the last three centuries that science had become traditionally established as a professional discipline, in its own right, with its specific literature and method. As Bernal (1986) states, "indeed science has so changed its nature over the whole range of human history that no definition could be made to fit it." Science manifested through technology has continuously advanced the state of civilisation in the developed world and is doing so today in the developing world.

Genuine scientific knowledge is the most important means of technological advancement in the modern world. It has also revolutionised man's life style and also brought about tremendous changes in the way of thinking, attitudes and outlook. The effect of science is visible all around us. Science has brought about changes in such important aspects such as health, communication, transportation, power etc. It can be stated without any hesitation that science has permeated and contributed in all walks of life. The different disciplines of science are stated below:

(a) Science deals with nature and environment, i.e., both the subjective and objective world and this aspect constitutes the natural science.

(b) Science deals with astronomy, physics, and chemistry and this facet of science is called physical science.

(c) Study of plants (botany) and animals (zoology) come under the purview of life sciences.

(d) Social sciences constitute yet another aspect – subjects such as psychology, sociology, political sciences, etc. come under this category.

(e) The language of science consist of mathematics, equations, symbols and graphic representation. Similar principles, laws and theories form the essential contents of science in addition to the observational instruments and allied equipments.

(f) Science is a systematised knowledge and adopts the scientific methods, the basis of which is both the deductive and inductive reasoning.

(g) Science is analytical. It breaks the whole into parts in order to operate upon it for the sake of knowledge. Science makes a fundamental assumption that a part of a phenomenon can be studied in isolation from the rest of the universe.

(h) Science is a great cultural force in the modern age. It has relieved mankind of ignorance, superstitions and fear. It has freed man's irrational beliefs and faiths. In this way science is a great antidote to fanaticism and has given man

the freedom of mind and freedom from physical and mental drudgery.

(i) Science is an observational and empirically testable study. Science concerns itself with those aspects of the world which can be measured and qualified.

The dominating feature of the contemporary world is the intense cultivation of science on a large scale and its application for the welfare of the mankind. The scientific and technological revolution has in turn enhanced the standard of living of the people. Science has led to the growth and diffusion of culture to an extent never possible before. It has not only radically altered man's material environment, but has provided new tools of thought and has extended man's mental horizon. It has thus influenced even the basic values of life and given to civilisation a new vitality and a new dynamism. The relevance and utility of the methods and techniques and the principles of science have become the basis of life in the present world. Hence it has become imperative to promote science education. Science has emerged as a significant field and its evergrowing body of knowledge has urged all the countries of the world to provide science education to all.

The Science Policy Resolution passed by Indian Parliament in 1958, is a significant landmark for scientific development in India. It sought to ensure for all the people of the country all the benefits that can accrue from the acquisition and application of scientific knowledge. It illuminates clearly and concisely the relationship of science to national goals and

development. The key to national prosperity, apart from the spirit of people lies in the modern age, in the effective combination of three factors - technology, raw materials and capital, of which first is the most important, since the creation and adoption of new scientific technique can, infact, make up for a deficiency in natural resources, and reduce the demands on capital. But technology can only grow of the study of science and its application (Sarabhai, 1974).

1.2 Significance of Science Education at the Secondary Stage

Science education is essential as it is of immense value to individuals life in society. The Education Commission (1964-66) was of the opinion that science education must become an integral part of the school education. A scientific outlook must be developed among the students so that it becomes part of their way of life and culture. The Commission felt that the quality of science teaching at all levels in the country has to be raised considerably, so as to achieve its proper objectives and purposes such as to promote an ever deepening understanding of basic principles; to develop problem solving and analytical skills and ability to apply the skill to the problems of the material environment and social living; and to promote the spirit of inquiry and experimentation.

The dawn of space age and explosion in knowledge have also necessitated the teaching of science. To be truly literate in the modern age, means that a person should be familiar with

the vocabulary of science and its concepts. The value of science education as a part of school curriculum is highly significant.

Science offers the content of knowledge and also is a method of acquiring knowledge. Scientific knowledge sharpens intellect and promotes intellectual honesty. Scientific language can report events with objectivity. Scientific principles and laws are universal and have wide ranging applications in everyday life. Knowledge of science is absolutely necessary for intellectual, material and moral development of the individuals.

The science education can develop positive attitude like open-mindedness, reasoning etc., which in turn is helpful to understand, evaluate and solve problems in day-today life. Study of science is a primary requirement for vocations such as medicines, engineering, agriculture, para-medicines, computers and science and technology based professions. It thus becomes quite clear that to enter into any such vocational course, an individual must have a basic knowledge of science and hence science has been included in all level of school curriculum.

Science basically unfolds the mysteries of nature, and the teaching of science is essential to appreciate the beauties of nature and for developing an aesthetic sense. Science education is not merely meant to give the pupils a quantum of knowledge. It aims at the inculcation of the spirit of inquiry and the habit of investigation. The teaching of science like any

other subject at the high school stage can also be justified for its intellectual, practical and cultural value. Through science education pupils acquire the ability to appreciate and apply the scientific method. Thus, it instils the pupils the quality to respect facts, to realise the role of observation and explanation, and to find the relationship among the facts observed. Devito and Krocjover (1976) discussing the purposes of science teaching mention the purposes as : (i) to familiarise students with a basic body of knowledge; (ii) to help students develop proper attitude towards science and the world of technology; and (iii) to assist students in acquiring the fundamental skills of science.

It is important to recognise that science as a subject is becoming increasingly complex and abstract. The new developments in physics, chemistry and biology make altogether novel demands on abstraction and conceptualisation of nature. This emphasises the need from the earliest stage of science education, for a proper understanding of the basic principles and the process of scientific abstraction and creative thinking. It must communicate to pupils a feeling for discovery and a realisation that science is open-ended and man's greatest intellectual enterprise today.

According to the Education Commission, (1964-66) "an understanding and application of the fundamental principles of natural and physical sciences is essential to live effectively in

the world today. The learning of science is based on the fundamental principles of 'learning by doing', 'learning by observing concrete and living specimens'. Being an activity oriented subject, science helps to satisfy basic human desire of knowing about wonders of nature and so it satisfies common instincts as creativeness, self assertion, curiosity, etc. Knowledge of science develops in an individual a capacity to critically examine facts and arrive at logical conclusions. Science develops scientific attitude among the students. The scientific method being the basis of science can analyse and solve the problems systematically. The scientific method also develops the creative problem solving ability. Thus, the multiple reasons for including science as an integral part of school education are many.

1.3 Science Education in the State of Meghalaya

The north-east Indian state of Meghalaya is a land locked territory of lovely hills with abounding sylvan beauty. The panoramic landscape presents a picturesque scenery. The state has an area of 22,489 square kilometres and a total population of 17,60,626 (males, 9,04,308 and females, 8,56,918). According to the 1991 census the state has a literacy rate of 48.26 per cent with male and female literacy rates 51.57 and 44.87 per cent respectively.

Meghalaya, "The abode of the Clouds" was granted autonomous statehood in 1970, by carving out the districts of

Garo Hills and United Khasi and Jaintia Hills from un-reorganised Assam. In 1972, it became a full-fledged state. The predominant population of this state comprises of Garos, Khasis and Jaintias. A distinguishing feature of the people of Meghalaya is the matrilineal matrix of socio-cultural milieu. The modes of inheritance and succession also is through the maternal lineage. At present Meghalaya comprises of seven districts namely East Khasi Hills, West Khasi Hills, East Garo Hills, West Garo Hills East Jaintia Hills, West Jaintia Hills and Ri-Bhoi District.

1.3.1 Development of Education in Meghalaya

Prior to the British period, certain types of ritualistic and technical education were existent in this part of the country. It is the Christian missionaries who introduced the formal education in this hilly region. Education ranks as the most important contribution of the Christian missionaries in Meghalaya. They have opened to the Khasis, Jaintias and Gars all the wide horizons of knowledge through literacy and education.

The missionary activities in the field of education in Meghalaya started in 1832 under Alexander B. Lish of Serampore Baptist Mission and initially three primary schools were opened at Cherrapunjee, Mawmluh and Mawsmai. However these schools were closed down after the Serampore Mission left the work in 1838. They were succeeded by the Presbyterian Mission from Wales, which began their work in 1841. Rev. Thomas Jones, the first missionary

established schools at the same venues where the schools were discontinued previously. He acquired a working knowledge of the language of the people and adopted the Roman script for the language.

The British Official Report (1864-65) on education has indicated that the schools were entirely under the management and control of the Welsh Presbyterian Mission who had established 50 schools by 1864 in this region. A normal school in the Khasi and Jaintia Hills at Cherrapunjee for training of teachers was started in 1867.

The records in the state archives reveal that there was no place for science in the school curriculum until the University of Calcutta, introduced "Elementary Science Knowledge" as an optional subject of study at the matriculation level in 1938 and the first examination was held in 1942-43. It was only after the independence, efforts were made to expand the formal education and to popularise science education. The Secondary Education Commission's (1952-53) recommendations also gave momentum for the expansion of education and introduction of science at various levels. However, it was only in 1976, science as a subject of study was formally introduced in the primary and middle stages, when the Government of Meghalaya implemented the UNICEF-assisted science education programme. Initially the programme was implemented on a pilot basis in 50 primary and 30 middle schools and the programme was extended every year.

Meghalaya Education Commission (1977) emphasised the need for introducing science as a compulsory subject and this was implemented in 1983.

In the year 1988, Government of Meghalaya issued a 'White Paper' on education. The White Paper spells out some significant measures for improving the standard of education both in lower and higher levels and also it regulated the service conditions of teachers. The state introduced the 10+2+3 National Pattern of Education in the year 1993.

Although much emphasis has been paid for science education, schools in Meghalaya face a number of problems in teaching of science at the secondary stage. There is a dearth of qualified and trained science teachers. Facilities for science teaching are very meagre. The classrooms and laboratories are ill-equipped. There is lack of text books and teaching aids. Very few schools have equipments as over- head and motion picture projectors. The schools find it difficult to get slides, films and such other amenities. The objectives of science teaching also has not been made clear to the science teachers. The subject matter of science also seems to be irrelevant. Apart from this, lack of interest and motivation, unfavourable attitudes and lack of encouragement from parents are other factors which negatively affect the students in their study of science subjects.

According to the Education Commission (1964-66) "if science is poorly taught and badly learnt, it is little more than burdening the mind with dead information and it would degenerate even into a new superstition. Science in the schools can and should make a difference in the lives of all children and the difference should be on the positive side".

1.4 Attitude as a Determinant of Behaviour

Attitude is one of the most distinctive and indispensable concept in scientific research and has attracted the attention of scholars from various fields, including education. It has become a valuable research construct in educational research. Attitude has been defined in a number of ways. Thurstone (1932) testifies attitude as a degree of positive or negative affect associated with some psychological object. By a psychological object, it is meant, any symbol, phrase, slogan, subject person or institution. According to Allport (1961) attitude is the mental and neural state of readiness, organised through experience, exerting a directive or dynamic influence upon the individual. Krech, Crutchfield and Ballachey (1962) consider attitude as an enduring system of positive and negative evaluations, emotional feelings and 'pro' and 'con' action tendencies with respect to a social object. All these definitions, consider attitude as a psychological condition which directs behaviour in relation to a defined area, concept, object or activity. Attitude thus can be taken as an enduring organisation of evaluative beliefs and a learned tendency varying

in degree, to react positively or negatively to certain class of objects, which determine the actual and potential responses of an individual. The various definitions illustrate that attitudes are selectively acquired and integrated through learning and experience, that they are enduring dispositions indicating response consistency. The positive and negative affect towards a social or psychological object represents the salient characteristic of an attitude. Thus it may be concluded that an attitude implies on the one hand, a well defined object of reference and on the other, a variation in the degree of strength and affect.

Attitudes are important in education because they affect learning, influence behaviour and guide pupils in their thinking. Attainment of educational objectives, acquisition of skills and information are dependent on attitude. A favourable attitude towards a subject motivates the pupil and instils interest to study the subject whereas the negative attitude may hamper the learning and motivation.

1.5 Formulation of favourable Student Attitude Towards Science

One of the major aims of teaching science is the development of scientific attitude. The National Society of the Study of Evaluation has defined Scientific attitude as " "Open mindedness, a desire for accurate knowledge, confidence in procedures for seeking knowledge and the expectation that the solution of the problem will come through the use of verified

knowledge." Finding answers to problems through direct observation, adequate experimentation, argumentation on facts, verification and testing of knowledge are some of the initial manifestations of scientific attitude. The importance of the scientific attitude has been highlighted by Thurber and Collete (1968) as : "attitudes developed by young people during their study of science can be as important as the skills they acquire and the knowledge they obtain. Attitudes regulate behaviour, not only in the classroom but in all other areas of human experience. Strongly positive attitudes permit growth; negative attitude hinder growth". From the academic view point , inculcation of positive attitude towards science among pupils is of the primary objectives of teaching science at the secondary stage of education. For inculcating positive student attitudes a number of measures and methods are suggested :

(i) provide learning experiences to relate the knowledge to student's immediate environment;

(ii) curriculum should be pupil as well as subject centred;

(iii) emphasises on self-learning and activity methods rather than bookish knowledge and rote memory;

(iv) individualised instruction and programmed learning should be encouraged;

(v) understanding that science is the basis for scientific and technological innovations and change.

(vi) positive reinforcement and feedback.

(vii) provide wide range of co-curricular activities such as debates, symposia, science fairs, science quiz, science exhibition, science club etc.

(viii) exposure through multimedia to the world of science depicting the achievements of scientists and how science has changed the course of life and civilization.

(ix) persuasive communication sessions such as short-term courses, buzz session etc. and

(x) there should be scope for experimentation and student participation in teaching-learning process.

1.6 Innovations in Science Education

The need to reform science education was felt in all countries of the world more or less simultaneously, immediately after the second world war. Many innovative projects have been undertaken in science education since the mid 1950s. Since some of the early projects did not adequately reach their target

population, as the courses were turned out to be excellent for the gifted students and too difficult for the rest and even for some of their teachers, the need for an inter disciplinary approach was recognised in 1956 by the Physical Science Study Committee. But the concept of integration in science teaching had to wait until the second-generation projects like Project Physics Course (PRC) and Earth Science Curriculum Program (ESCP). In 1969 UNESCO launched an integrated science teaching programme. Perhaps one of the main thrusts in the near future will be co-ordination and integration in the teaching of the sciences and greater concern for the integration of science into the whole curriculum.

1.6.1 Integral Science Teaching

It consists of those approaches in which the concepts and principles of science are presented so as to express the fundamental unity of scientific thought and to avoid premature or undue stress on the distinctions between the various scientific fields. Thus the concept of integrated science teaching is based on the parallel assumption that the universe has an inherent unity and that science as an attempt to provide an understanding of the natural world, has a unity of purpose, content and process, that is far more significant than the difference in language or forms between individual sciences (Baez, 1976). Programmed instruction and audio-tutorial methods are also need to be employed in the teaching of science.

1.6.2 The Topic Method

The topic method of arranging the course appears to be the most suitable for general science meant for young minds. It consists in grouping the whole subject matter around a certain number of well chosen topics, which bear a direct relation to the environment and interests of the pupils. This way of arranging the topics will afford plenty of opportunities for relating the subject to local condition and personal problems. However, if this method is followed to the exclusion of all other methods, it will be difficult to cover all the important aspects of a subject.

1.6.3 The Concentric method

In this method each succeeding year, the whole course covered is constantly increased in depth and detail, rather than exhaustively treating one particular subject in one single year. In the case of the younger pupils, this is a useful method and it makes it easier to adapt the contents of the course to a particular stage in the development of pupils.

1.7 Systems Approach to Science Education

Systems approach is considered to be one of the revolutions in education. If man ever conceived of systems in business, industry, education or any form of management, it was because he observed the elegance of the systems in nature, the smoothness of their operation and their meaningfulness in life. Systems approach is important for school administrations,

teachers, managers or principals, to view their institutions as a systems model, consisting of smaller systems within greater systems. To manage science education in a better way, it is wise to consider the systems approach.

In designing an effective system , the two processes which normally used are system design and system analysis. System design involves setting out objectives, delimiting the scope of the system, thinking of possible sub-systems and their inter relationship, feasibility of the sub-systems, modelling of the sub-systems, try-out of the model system and construction of the final system. Systems analysis is the process which enables decision makers and practitioners to examine carefully and systematically the various aspects and evolve strategies to implement them. Systems analysis is generally done when there is a problem. The existing system of education with a number of problems demands careful systems analysis in order to find suitable alternative solutions to the problems.

Science education is one of the components of the educational system and therefore any innovation in science education, in order to be successful, should be viewed in relation to other components of the system. The application of systems approach helps to reduce the chances of oversight or the occurrence of so called 'appraisal gaps'. And this is achieved by using a structured technique to continuously identify and assess the impact of changing objectives, constraints and design

criteria on required resources and available resources, technologies, personnel and facilities. Systems approach can help in building internal consistency, that is every component of particular system fits well with each of the other parts and functions in harmony with them. It also helps in analysing the problems and developing alternative systems. It also develops professional skills and competencies in the prospective teachers, administrators, planners and researchers to deal with the educational problem confidently and intelligently. Knowledge of systems approach, in brief, can give the science teacher much of what he needs to achieve his goals by enabling him to understand, design and manage instructional systems to optimise out-put. It helps planners in analysing the problems of science education, and planning viable and efficient systems. It also enables educational managers to analyse an educational system in terms of its structural, functional and operational components with a view to improve the science education system. Since science is a subject of the total curriculum the systems approach can be applied to it (Bixby, 1969). In the concept of management of teaching- learning, Davis (1982) says teacher is the manager because the teacher has to organise teaching activities first and then he has to perform these activities in the teaching process. The design of teaching learning system consists of four steps such as (i) planning, (ii) organising, (iii) leading and (iv) controlling. The various activities included in these four steps are as follows : (1) Analysing of the whole system, (2) Task analysis, (3) Evaluating behaviour of the learner, (4)

Specification of knowledge, skill and attitudes of students, (5) Identifying the student's needs, (6) Formulation of learning objectives, (7) Organising learning resources, (8) selecting appropriate teaching strategies, (9) Encouraging and motivating students activities, (10) Evaluation of teaching system, (11) Learning the teaching system, (12) Observing the learning system, (13) Modification in the teaching- learning system, (14) Planning for the criterion test and (15) construction of the criterion test.

1.8. Need and Significance of the Study

Secondary education has a strategic position in the whole scheme of education for several reasons. First, secondary education lays the foundation of all higher education. Second, it should be the terminal stage for many who, after well directed additional training, have to fill the middle level working positions - technical, vocational and professional. In spite of this situational importance, secondary education has always been and still remains the weakest link in the chain. So any programme for the re-organisation and improvement of the system of education must pay special attention to the secondary education.

Science holds a unique place in the curriculum, in that it can play a vital role in the development of human potentials. Every country develops its system of education to meet the challenges of changing times. The progress, welfare and security of a nation depends on the scientific research done in its

laboratories and the type of science education imparted in schools. Progress in science, is the key to progress in all walks of life. But the present educational system, in India, does not seem to meet the requirement of a growing economy and is lagging other nations in the race of scientific progress.

The schools of Meghalaya face a number of constraints in imparting science education. Science was a neglected subject till recently and Meghalaya followed the traditional science curriculum of pre-independence day till 1990. The new science syllabus was introduced in the high schools of Meghalaya from 1991 onwrds. However, the problem remains about the qualitative and quantitative improvements of science education such as providing facilities, recruiting qualified and trained teachers etc. Meghalaya government has taken certain steps to improve the status of science education in the state. The State Council of Educational Research and Training, through its Science and Mathematics Units has undertaken many projects and activities which include the teacher in-service programme, the improvement of curricular materials and the student enrichment programme. The service rendered by Meghalaya Science Society is also worth mentioning in this context. A Centre for Science and Mathematics education has been created by North-Eastern Hill University for the propagation of science in this state. With these efforts, of late, there is a considerable improvement and interest among the students to take up science courses even at the university levels. However, the overall picture of science education is not

very encouraging. Hence the position of science education in this part of the country also deserves the attention. There is scarcity of qualified and trained science teachers and the schools are lacking in facilities like laboratory, teaching aids, equipment and even literature for the proper teaching of science. Very few studies have been conducted in the field of science education in this region. There is not much effort to analyse the problems of science teaching. The present study attempts to probe into the difficulties and constraints in imparting science education in the high schools of East Khasi Hills District of Meghalaya.

One of the important factors for success in science education is the development of favourable attitude of students towards science. Development of favourable attitude pertinent to the promotion of science education constitute a necessary end product of education. There was not a single study undertaken till date to analyse the attitude of science students in Meghalaya. It is also necessary to teach science in such a way as to inculcate a positive and favourable attitude among the students towards science. The present study planned to examine the student attitude towards science and also seeks to throw light on the influence of a number of activities such as science club, fairs, exhibition, quiz etc. on the attitude of students towards science. The significance of the study is enhanced as the findings of this research will be helpful to the improvement of science education at the secondary stage. The research will be

helpful for the teachers to evolve strategies for inculcating favourable attitudes among students towards science. This study shall also subscribe means for propagating science related co-curricular activities in schools.

1.9. Statement of the Problem

The present research is designed to find out the problems and constraints of teaching science at the high schools in East Khasi Hills District of Meghalaya. Problems related to strength and quality of teachers, methods used in teaching, availability of teaching aids, laboratory facilities and science club etc. were examined. The opinion of the science teachers were sought to improve the science instruction in schools. The study also attempts to analyse the students' attitude science. A Science Attitude Scale [SAS] has been constructed for this purpose and the student responses on the four dimensions of the science attitude scale such as planning, organisation, leading and controlling were compared with gender, ethnicity, locale and type of Schools. As such the study is entitled "A Study of the Problems of Science Education and Attitude of Students Towards Science in High Schools of East Khasi Hills District, Meghalaya".

1.10. Definition of Terms Used in the Study

(i) Problems of Science Education :

The difficulties and constraints encountered by the schools in imparting science education in the high schools are

taken as the problems of science education. These problems were identified with the help of a questionnaire from the science teachers.

(ii) Science attitudes

The present study accept the term attitude as an enduring system of positive and negative evaluation, emotional feelings with respect to science as a subject of study. The student responses on the statements of the Science Attitude Scale is taken as a measure of the science attitude.

1.11. Objectives of the Study

The following are the main objectives of the study:

(i) to study the problems and constraints of science education at the high school stage with special reference to teaching of physics, chemistry, biology and health science;

(ii) to construct and standardise a Science Attitude Scale for the students of class IX;

(iii) to compare the science attitude of students on the basis of gender, ethnicity, locale and type of schools'; and

(iv) to examine the influence of science clubs, science quiz, science exhibition etc., on the students' attitude towards science.

1.12. Hypotheses

The hypotheses advanced for the research are as follows:

(i) there is no significant difference between male and female high school students in their attitude towards science;

(ii) there is no significant difference in the science attitudes of students belonging to different type of schools;

(iii) there is no significant difference between the attitudes of urban and rural school students towards science; and

(iv) there is no significant difference between the attitudes of tribal and non-tribal school students towards science.

(v) there is no significant interaction among the variables such as sex, type and locale of school on the attitude of students.

1.13. Procedure of Study

The study was undertaken on a sample of 80 science teachers and 1000 students of class IX from 30 selected high schools of East Khasi Hills District of Meghalaya. The data for the study were gathered by administering a questionnaire to the teachers for identifying the problems in teaching of science and a Science Attitude Scale to students. Statistical techniques such as Analysis of Variance, t-test, and Chi-Square test were applied for analysing the data. Percentages, frequency distributions, measures of Central Tendency and Dispersions were also used to describe the data.

1.14. Scope and Limitations

The science education in the state of Meghalaya needs special attention and the present research is a pioneering attempt to analyse the problems of science education and evolve strategies for improving science education. The research is intended to identify the constraints and difficulties in the teaching of science at the secondary level and also will seeks ways and means to solve them. The study also analyses the factors relating to student attitude towards science, and help to implement new science curriculum in the high schools of Meghalaya. The study is delimited to the schools following Meghalaya Board Syllabus for science education. The investigation is further confined to class IX students from the high schools of East Khasi Hills District. The problems and constraints in science education have been analysed on the basis of

questionnaire data collected from 80 science teachers from 30 high schools.

1.15. Organisation of the Report

The research report has been presented in five chapters. The introductory chapter discusses the need and significance of the study, enunciates the problem, objectives and scope and limitations of the study. A review of related research pertaining to attitude towards science, and problems in science education, conducted in India and abroad are given in the second chapter under two sections. The method and procedure of the study has been described in chapter three. The sample, the development of tools, the procedure for data collection, and the statistical techniques used for the analysis of data are presented in detail in this chapter. The analysis of data has been undertaken in chapter four. The chapter is divided into three sections. Section I deals with the analysis of problems related to the teaching of science as a subject at the secondary stage. The analysis of the attitude of students towards science is undertaken in section II. Section III deals with the relation between certain aspects of science education and the science attitude of students. The summary of the study along with the relevant findings and suggestions are given in the final chapter five. The report also includes a list of books and articles relevant to the science education at the secondary stage. A copy of each of the tools used for data collection is attached as appendix I - the questionnaire for the science teachers and appendix II - the Science Attitude Scale (SAS).

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